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MINERGY CORPORATION
GLASS FURNACE TECHNOLOGY EVALUATION

INNOVATIVE TECHNOLOGY EVALUATION REPORT

National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
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NOTICE

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FOREWORD

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, EPA strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (Laboratory) is the Agency's center for investigation of technological and management approaches for reducing risks from threats to human health and the environment. The focus of the Laboratory's research program is on methods for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites and groundwater; and prevention and control of indoor air pollution. The goal of this research effort is to catalyze development and implementation of innovative, cost-effective environmental technologies; develop scientific and engineering information needed by EPA to support regulatory and policy decisions; and provide technical support and information transfer to ensure effective implementation of environmental regulations and strategies.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

Lee Mulkey, Acting, Director
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ABSTRACT

This report presents performance and economic data for a U.S. Environmental Protection Agency (EPA) Superfund Innovative Technology Evaluation (SITE) Program demonstration of the Minergy Corporation (Minergy) Glass Furnace Technology (GFT). The demonstration evaluated the technology's ability to reduce polychlorinated biphenyl (PCB) and metal concentrations in river sediment.

GFT was developed by Minergy to remove PCBs, other organics, and metals from river sediment. The GFT consists of a dryer, a melter, and an air pollution control system. After drying to about 10percent moisture, the dried sediment is mixed with a flux material to control melting temperatures and improve the physical properties of the glass aggregate product, and introduced into the melter. The sediment is heated in the melter to a temperature of about 1,600 degrees Celsius (°C), at which temperature the sediment is molten. At these high temperatures, PCBs and organic contaminants are destroyed or removed, and metals are encapsulated within the glass matrix. The molten sediment exits the melter into a water-quench bath, where it quickly hardens and shatters to form glass aggregate that, Minergy maintains, has reuse value.

Laboratory tests of sediment samples collected during a pilot dredging project on the Lower Fox River, Wisconsin, indicated that the sediment was suitable for melting using the GFT. A demonstration of an indirect-disk or paddle dryer, the intended type of dryer for a full-scale implementation of the GFT, was conducted by Hazen Research, Inc., at its facility in Golden, Colorado in January 2001. A pilot-scale melter was designed and built at Minergy's facility in Winneconne, Wisconsin, where the GFT demonstration treated a total of about 27,000 pounds of dried sediment in the Summer of 2001.

The primary objective for the GFT technology demonstration was to evaluate the treatment efficiency of PCB destruction or removal by the GFT process during the demonstration period. Results of the demonstration indicate that Minergy's GFT removed 99.9995 percent of the PCB contamination in the sediment.

This technology is potentially applicable at hazardous waste sites where river sediment has been impacted by PCBs, other organics, and metals. Economic data indicate that remediation costs of using GFT are affected by site-specific factors, such as local land prices and site suitability. The cost for treatment using a full-scale treatment facility, constructed at a location in proximity to sediment removal activities, was calculated to be $38.74 per ton of dredged-and-dewatered sediment (containing about 50 percent moisture). Treatment costs, which are affected by the amount of moisture in the sediment and potential end use of the glass aggregate, are based on operating a melter on an average of 600 tons of sediment per day over a 15-year project life.

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ARARs	Applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
CAA	Clean Air Act
CAMU	Corrective action management unit
°C	Degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of concern
Comp	Composite
DOT	Department of Transportation
dryer	Indirect heat disk or paddle dryer (can we delete this one?)
EPA	U.S. Environmental Protection Agency
°F	Degrees Fahrenheit
FS	Feasibility study
GFT	Glass Furnace Technology
GLNPO	Great Lakes National Program Office
Hazen	Hazen Research, Inc.
HSWA	Hazardous and Solid Waste Amendments
ID	Identification
ITER	Innovative Technology Evaluation Report
J	Estimated
kg/hr	Kilogram per hour
kj	Kilojoule
kWh	Kilowatt-hour
Laboratory	National Risk Management Research Laboratory
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LDR	Land Disposal Restriction

ACRONYMS, ABBREVIATIONS, AND SYMBOLS (Continued)

M	Million
melter	Minergy's pilot-scale melter
Minergy	Minergy Corporation
mg	Milligram
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
MS	Matrix spike
MSD	Matrix spike duplicate
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
ND	Nondetect
NPV	Net present value
O_2	Oxygen
OMB	Office of Management and Budget
ORD	EPA Office of Research and Development
OSHA	Occupational Safety and Health Act
OSWER	Office of Solid Waste and Emergency Response
oxy-fuel	Oxygen and natural gas mixture
P	Primary
Paradigm	Paradigm Analytical Laboratories
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
%R	Percent recovery
PPE	Personal protective equipment
ppm	Parts per million
ppt	Parts per trillion
PW	Present worth

ACRONYMS, ABBREVIATIONS, AND SYMBOLS (Continued)

QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	Resource, Conservation, and Recovery Act
S	Secondary
SARA	Superfund Amendments and Reauthorization Act
SITE	Superfund Innovative Technology Evaluation
SMU	Sediment management unit
SPLP	Synthetic Precipitate Leaching Procedure
SVOC	Semivolatile organic compound
Tetra Tech	Tetra Tech EM Inc.
TE	Treatment efficiency
TEQ	Toxicity equivalent
TER	Technology Evaluation Report
tons/day	Tons per day
TSCA	Toxic Substances Control Act
TSD	Treatment, storage, and disposal
TSS	Total suspended solids
UCL_{95}	95 Percent upper confidence limit
VOC	Volatile organic compound
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources

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